Task 15: Development of a Common Automation Platform (Crutchfield)

Program Manager: Dino Piccione, AJP-61, (202) 493-5305

Task Customers/Sponsors: Dino Piccione, AJP-61, (202) 493-5305

Performing Organization: Jerry Crutchfield, AAM-520, (405) 954-4537, jerry.crutchfield@faa.gov, Dennis Rester, AAM-500, (405) 954-7449, dennis.rester@faa.gov

University/Contract Performing Organization:
Gallium Visual Systems Inc.

Project Start Date: October 2009 **Anticipated End Date:** Sept. 2013

Requirements Statement
Operational Shortfall or Knowledge Gap The FAA is planning for the development and implementation of a single workstation configuration that will provide the information and functional capabilities needed for both en route and TRACON air traffic control tasks as needed. This single workstation configuration is being referred to as the Common Automation Platform (CAP). The development of the CAP requires human factors input, including en route and TRACON controller information requirements, suggestions for how the en route and TRACON displays and interfaces can be converged without making controller tasks more difficult, and evaluations of the usability of alternate design features.
Benefit in Closing the Shortfall or Gap The results will inform the development of a CAP for NextGen. A CAP designed without the benefit of human factors requirements risks the development of displays that lead to inefficiencies and errors. In the air traffic control environment, these errors could have negative safety implications. Considering human factors requirements early on in the development process reduces the risk of a costly re-design occurring prior to implementation.
Description of the Desired Product The desired product is a set of human factors requirements regarding the design of a CAP for NextGen en route and TRACON functions.
Schedule The NAS Architecture 6.0 calls for a CAP to be operational in 2015. Human factors requirements for the workstation design will be needed as early as possible in the design phase of the CAP.

Research Objective
The overall objective of this task is to provide human factors guidance to the development of a CAP workstation for NextGen en route and TRACON functions. This guidance will take the form of a set of human factors requirements for the CAP workstation. Sub-objectives that need to be accomplished on the way toward completing the overall objective include the development of prototype CAP display simulations, and the collection of human factors data regarding the use of these prototypes.

Background

The systems in use by today's air traffic controllers were developed primarily to meet the requirements of the ATC environment in which they were to be implemented. En route displays were not developed to support TRACON functions and neither were TRACON displays developed to support en route functions even though certain functions, such as air traffic surveillance, are common to both. The implications of having unique systems in the different ATC domains include higher costs and inefficiencies with regard to training personnel, acquiring equipment, and system maintenance. For the purpose of optimizing efficiency, the FAA is currently planning for the development and implementation of a single workstation configuration or Common Automation Platform (CAP) that will provide the information and functional capabilities needed for both en route and TRACON air traffic control tasks as needed. It is believed that proposed changes associated with ATC modernization efforts will facilitate the implementation of a CAP whereas it could not have been accomplished in the past.

Previous Activity on this Task

While this is a new task and no previous activity has been performed by this Principal Investigator, work related to a CAP has been accomplished by other researchers. Work on future TRACON displays (such as the Future Terminal Work Station or FTWS) has been carried out by researchers at the FAA's William J. Hughes Technical Center (WJHTC) as well as researchers at NASA Ames Research Center. Work on future en route displays (such as the Future En Route Work Station or FEWS) has been carried out by researchers at WJHTC and Volpe as well as ERAM developers at Lockheed Martin. Studies regarding the convergence of en route and TRACON displays have been carried out by researchers at MITRE and a joint NextGen Convergence Working Group. The work described in this task proposes to rely heavily on the work done prior to this task and leverage any recommendations that have resulted thus far.

Proposed or Planned Research

The overall objective of this task is to provide human factors guidance, in the form of requirements, to the development of a CAP workstation for NextGen en route and TRACON functions. Eleven sub-tasks will be completed: 1) collect available en route and TRACON controller workstation requirements including functionality and information requirements, prioritize the requirements by when they are expected to be needed during the implementation of NextGen, and apportion them for use in the development of a series of simulated prototype workstations; 2) contract with simulation developers to create a series of simulated prototype workstations based on the above requirements; 3) build the first version of the workstation; 4) perform human-in-the-loop evaluations of the first version of the workstation; 5) document the information requirements that result from the literature review and evaluations; 6-11) iterate through the building, evaluation, and documentation of results for two more versions of the simulated prototype workstations.

Research Question(s)

1. What displayed information do en route and TRACON air traffic controllers need to perform NextGen ATC tasks?
2. What aspects of the en route and TRACON ATC displays naturally converge?
3. What aspects of TRACON and en route displays can be converged while continuing to foster the safe and expeditious control of air traffic?
4. How will various display aspects fare with regard to being rated in usability by a sample of qualified users?

Technical Approach

Current Year

Fiscal year 2010 will be spent documenting a concept of operations for the CAP, gathering the requirements needed to enable appropriate simulated CAP prototype workstation development and putting in place the contract vehicle to support future simulated prototype workstation activities.

A contract will be put in place to provide simulated CAP prototype workstation capabilities. The selected contract programmer will work closely with AAM-500's Human Factors Simulation Technology Specialist to develop a simulated prototype display that merges functions proposed to be used on NextGen en route and TRACON displays. As Gallium Visual Systems Inc. has provided AAM-520's ATC simulation software to this point and recently proposed upgrading our simulation with capabilities that will be needed for this task, they seem the likely candidate for this contract.

Out-Years

During fiscal year 2011, Version A of the simulated CAP prototype workstation will be both developed and tested through an iterative rapid prototyping and human-in-the-loop evaluation technique. The results of the requirements review from 2010 and evaluations of the workstation in 2011 will be documented and delivered in September.

Fiscal year 2011 will begin with the first of two simulation requirements definition meetings. The contractors will meet with CAMI personnel in Sept. 2010 to finalize and sign off on CAP en route requirements for Version A. The contractor will develop and deliver a NextGen en route R-Position display capability similar to that of ERAM, added to the existing ATCARS Radar Simulation System. This display is to be delivered by the beginning of Feb. 2011. It is assumed that the NextGen en route display capability will not be a 100% replica of the operational ERAM display. The primary purpose of the requirements definition meeting is to prioritize the functionality we would like the display to have and determine which functionalities can be included in the time frame.

The second simulation requirements definition meeting will be held in Feb. 2011. During this meeting, the contractors will meet with CAMI personnel to finalize and sign off on CAP TRACON and display convergence requirements for Version A. Starting in late Feb. or early March, CAMI human factors and programming personnel will meet with controller Subject Matter Experts and contractor code developers to elicit requirements from the SMEs and to prototype TRACON and display convergence features. The contractors will deliver the next display in May 2011 when it will be evaluated. The iteration of rapid prototyping and evaluation will be repeated for a display delivery in June and the results of the evaluations will be integrated with pre-existing requirements to comprise the document for CAP Version A requirements.

In fiscal year 2012 a similar process will be conducted for Version B, and in 2013 for Version C.

Air Traffic Resources Required
Input will be needed from both en route and TRACON air traffic control SMEs. It is not required that these SMEs be NATCA-represented controllers.

Information Technology Resources Required
This task will require significant modifications and upgrades to AAM-520's ATC research simulation capabilities. Our capabilities will initially need to be upgraded to provide a higher fidelity communication system, import and use PDARs data to develop scenarios, and represent the functionality found on ERAM displays. Furthermore our simulation capabilities will need to be expanded to represent as many as four workstations at once.

In addition to our Simulation Technology Specialist's involvement in the above activities, it will also be necessary for this specialist to work extensively with a contract programmer in developing the CAP display simulation demonstration by March 2011.

Calibration
Not Applicable.

FY10 Milestone Schedule		
Description	Proposed Start Date	Proposed Completion Date
Development of a CAP Concept of Operations	Jan. 2010	Sept. 2010
Documentation of Simulated CAP Prototype Workstation Requirements	Feb. 2010	July 2010
CAP demo contract in place with Gallium	Jan. 2010	Sept. 2010
Build Simulated CAP Prototype Workstation Version A	Sept. 2010	March 2011
Usability study: Version A	Jan. 2010	Sept. 2011
NextGen CAP Requirements for Version A	March 2011	Sept. 2011
Build Simulated CAP Prototype Workstation Version B	Sept. 2011	March 2012
Usability study: Version B	Jan. 2012	Sept. 2012
NextGen CAP Requirements for Version B	March 2012	Sept. 2012
Build Simulated CAP Prototype Workstation Version C	Sept. 2012	March 2013
Usability study: Version C	Jan. 2013	Sept. 2013
NextGen CAP Requirements for Version C	March 2013	Sept. 2013

FY10 Deliverables		
Description	Proposed completion date	Actual completion date
Requirements for Simulated CAP Prototype Workstation	July 2010	
CAP Concept of Operations	Sept. 2010	
Demo display simulation: NextGen CAP Version A	March 2011	
NextGen CAP Requirements for Version A	Sept. 2011	
Demo display simulation: NextGen CAP Version B	March 2012	
NextGen CAP Requirements for Version B	Sept. 2012	
Demo display simulation: NextGen CAP Version C	March 2013	
NextGen CAP Requirements Combined	Sept. 2013	

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